

Appendix B to Beaumont-Port Arthur Conceptual Model
An Analysis of NO_x and VOC Limitations
in the Beaumont-Port Arthur Area with MAPPER
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The objective of this study is to analyze NO_x and VOC limitations in the Beaumont-Port Arthur (BPA) area. Understanding where and when ozone formation is limited by VOC or NO_x will help us to determine ozone control strategies.

This analysis used the MAPPER (Measurement-based Analysis of Preferences in Planned Emissions Reductions) program for determining NO_x or VOC limitations. MAPPER uses the Smog Production algorithm (SP) to approximate where and when peak ozone concentrations are limited by the availability of VOC radicals or nitrogen oxides. Because the SP algorithm uses ambient data, the accuracy of its results depends greatly on the accuracy of the input data. This includes the concentrations of ozone, nitric oxide (NO), and either NO_x (NO₂ + NO) or NO_y (NO₂ + NO + nitrate radicals and other oxidized nitrogen products). The SP algorithm calculates the extent of reaction, a number that ranges from 0.0 to 1.0, and which categorizes an area as being either VOC limited (0.0 to 0.6), transitional (0.6 to 0.9), or limited (0.9 to 1.0).

Input data files were created for use in MAPPER using hourly, ambient ozone, NO, and data for the BPA area from 2000 to 2001. The following procedure was employed:

1. For each site, the five days with the highest peak hourly ozone values were selected;
2. For each site and day, the five hours surrounding the peak ozone hour were selected; and
3. For each site, the median extent of reaction were calculated from the 5 daily 5-hour extents.

The median extents of reaction for BPA area are shown in Table 1 below for 2000 through 2002. If the extent is less than 0.6, then the site is strongly indicative of VOC limitation. If the extent is greater than 0.9, the site is strongly indicative of limitation. If the extent is between 0.6 and 0.9, the site is considered transitional, meaning that the area could have either limitation. The transitional limitation can further be broken down so that if the median extent is between 0.6 and 0.7, the area is considered VOC transitional. If the median extent is between 0.8 and 0.90, the site is considered transitional. If the median extent is between 0.7 and 0.8, it is considered simply transitional.

Results of this study indicate that the median extent of reaction for BPA at five of the monitors was transitional for each year from 2000 through 2002. Only one monitor was limited during this time period. This monitor, Sabine Pass, was limited in 2000 and 2001, but was calculated to be transitional in 2002. These results also show some geographical patterns. The Beaumont C2 site shows a median extent within the range that is considered VOC-transitional. The West Orange site changed from VOC-transition to -transition. The Sabine Pass site changed from strongly to transitional, and others sites changed from VOC-transitional to transitional.

Table 1: Median Extent of Reaction (MER) in the BPA Area for 2000-2002

Site	2000 MER	Limitation Type	2001 MER	Limitation Type	2002 MER	Limitation Type
Beaumont C2	0.66	VOC- transitional	0.62	VOC- transitional	0.60	VOC- transitional
West Orange C9	0.65	VOC- transitional	0.70	transitional	0.83	NOx - transitional
Hamshire C 64	0.68	VOC- transitional	0.79	transitional	0.75	transitional
Mauriceville C642	0.63	VOC- transitional	0.69	VOC- transitional	0.71	transitional
Airport C643	0.68	VOC- transitional	0.66	VOC- transitional	0.73	transitional
Sabine Pass C640	1.00	NOx	0.92	NOx	0.76	transitional